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The role of research in the future of the agro-food sector

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The role of research in the future of the agro-food sector

In the agro-food industry, in line with the European Commission's White Paper on Food Safety, it is now firmly acknowledged that quality must be planned and developed throughout the food production chain, irrespective of whether the food is of plant or animal origin. Food safety depends on all operators in the food sector, specifically with regard to foods of animal origin, where safety begins with animal nutrition and, even before that, in the "field".

The objective of food safety must be viewed in the context of a dynamic situation which is the result of advances in knowledge, the development of investigative tools and the results sought in terms of guarantees to be provided to consumers.

With respect to food of animal origin, present-day consumers are concerned about a series of problems which, apart from intrinsic food safety issues, ultimately involve a whole set of aspects typical of the productive system. These include worker protection, environmental safeguards and, today, even animal welfare, though the possibility of identifying which foods are obtained with "animal-friendly" methods is still hardly present in many countries, given current labelling practices.

Thanks to the know-how and technology it provides, in the agro-food sector science takes on the characteristics of a productive force. Orienting research toward major product or process innovations makes it possible to significantly increase a country's level of competitiveness and in this challenge every level of study, including the most basic research, is useful and valuable.

A fundamental role is played by interdisciplinarity as it is imperative, particularly in agrarian research, to transcend a single-discipline approach when undertaking complex research. In addition, various levels of coordination are increasingly necessary in order to identify cooperative forms of research.

One of the most interesting lines of development being brought to the attention of civilised society is founded upon the strategic role that local systems can play in addressing the dimension of globalisation. In other words, given increasing international competitiveness, the vitality of each system and its components will be correlated with the extent to which the peculiar territorial, social, economic and cultural attributes of the system itself can be successfully exploited. The winning formula should be a strongly integrated organisation and management of all local components. Here research must play a leading role, and universities will inevitably be at the forefront.

It is also important, however, that all those interested in developing knowledge and innovation act like part of a team, while maintaining their respective autonomy. Science for the sake of science cannot be the primary objective of a society. Rather, it is fundamental to build, within the various fields, a scientific atmosphere conducive to their own development. That is to say a scientific atmosphere in which research is first given direction based on a constructive dialogue with potential beneficiaries (agricultural sector and consumers), then carried out, later disseminated and, finally, correctly applied.

When planning research in the food sector, for example, we might wish to consider, from a broadened perspective, which needs of the human population we intend to satisfy today:

a minimum availability of energy to assure the survival of each (around 2000 cal/day) or a "correct" availability of foods such as to permit a mixed diet, which not only supplies 2500-3000 cal/day, but also avoids the negative consequences both of malnutrition (specific deficiencies) and overeating (diabetes, obesity, cardiovascular disease, cancer)? Furthermore, is it worthwhile to allocate a large part of plant crops to feed animals when we lose 75-85% of the original energy and protein? The answer is spontaneously affirmative, it being universally acknowledged that foods of animal origin are essential to the human diet; but also of relevance here is the fact, perhaps less often considered, that animals often act as intermediaries between plants and humans by favouring the use of several essential nutrients and also play a part in eliminating some natural substances contained in plant-derived foods that produce negative effects (antinutritional substances, alkaloids, mycotoxins).

Many scientific innovations have guided development in the agro-food sector in recent years:

Precision farming; sustainable crop production and integrated and organic farming methods; genetic studies on cold tolerance and drought resistance in cereals; phytoremediation of polluted soils; non-destructive methods for evaluating fruit quality.

Agrarian biotechnology; GMOs and the well-known problems associated with them; development of parasite-resistant crops; genetic plant improvement geared toward meeting consumer demands and the quantitative needs of the world population; advanced entomological biotechnology; product entomology; selection of queens and relationship with honey quality.

Process innovation in the field of food technology aimed at improving safety while fully maintaining the healthful qualities and sensory characteristics of food products; functional foods; studies on aroma composition in food matrices. Considering the strategic interest in domestic production, research in the sector of food technology also has the objective of safeguarding typical national products against imitations and identifying analytical markers capable of discriminating environmental, genetic or technological variables related to distinctive characteristics.

Food-processing microbiology, with the quest for high-quality starters in the field of winemaking, studies on acetic bacteria and traditional balsamic vinegar, dairy microbiology and, more recently, microbiology of typical cured meat products; improvement in the strains used; microbiological monitoring aimed at assuring food safety and verifying the origin of foods; recycling and use of biomass and residues; biotechnology applied to depolluting organisms.

Technological progress, including mechanisation, is one of the factors that has most greatly contributed to the notable evolution of agriculture in general and husbandry in particular in the past few decades (computerised monitoring, microclimate control and robotics), along with embryo transfer, ruminal bypass of protein, ideal protein, innovative analytical techniques for isolating antinutritional or toxic substances; genetic improvement to enhance efficiency. Plus, more recently: effects of nutrition on the dietary/nutritional and sensory quality of foods and environmental impact; production of functional foods through supplementation with nutraceutic components such as conjugated linoleic acid (CLA) isomers in milk and meat, lipoic acid and omega-3 fatty acids; enrichment with iodine and

selenium; improvement in the quality of animal feeds and feeding techniques (storage systems and hygiene- and health-related characteristics of forage and concentrates); genetic indexes, marker-assisted selection; animal welfare and its role in defining quality.

The sector of typical products is perhaps the one in which we have seen the greatest commitment, on the one hand, to safeguarding production methods that derive directly from tradition and are justly treated as "untouchable", since any departure would undermine the very concept of a typical product; on the other hand, to a greater or lesser extent according to the type of product, those involved in the production chain have taken on a role as "controllers" of all stages of production, including activities in the field or in the stable and every step that raw materials must go through, from harvest or slaughter to the first processing phases, to the obtainment and certification of finished products and any derivative products. A noteworthy example is the production chain of two of Italy's (and Europe's) leading PDO products: Parma and San Daniele ham, both subject to complex production regulations, with hosts of experts scrutinising each step in order to detect any non-conformities, frauds or defects; both have also inspired incessant research, often conducted in partnership with universities, aimed at finding methods of analysis, production variants, etc. that preserve their characteristics and global image in the eyes of consumers.

It is interesting to go back again to the relationship between scientific innovations and agro-food culture. Plant nutraceutics is based, for example, on foods rich in iron, selenium and iodine and the antioxidant action of red wine polyphenol. One of the research objectives is to assess to what degree the reduction of oxidative stress may have been a factor influencing the food-drink combinations dictated by tradition.

Even in the field of typical products, and agro-food products in general, it is worth highlighting some recent signs of a reversal in trends: safeguarding of biodiversity, greater degree of extensivity, sustainability.

Finally, all the research and newly acquired methods aimed at assuring traceability throughout the production chain and beyond are founded on a crosscutting, interdisciplinary approach.

I think it is possible to conclude by affirming that the approach to typical products will continue being successful, as it is aimed not at people who eat just for nourishment, but rather at those who eat for the pleasure of eating. Moreover, typical products may also be promoted with an eye to the global market, provided that quality is guaranteed by constant, recognisable standards. Without presuming to replace more traditional models whose contents have been profoundly renewed, as we have seen, by science, a fragmented supply may be transformed into an important resource to place alongside the other fundamental objective we must set for ourselves, i.e. to reduce the number of steps between production and consumption. Upholding these positions will also enable us to keep on speaking, in the future, of "agro-food culture".

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(*) from the speech given at the inaugural ceremony of the 830th academic year of the University of Modena-Reggio Emilia.